WE CLAIM:

1. An all-optical switching site for an agile optical network connected to at least one input optical fiber link and at least one output optical fiber link, each of which transport a plurality of wave division multiplexed (WDM), or dense wave division multiplexed (DWDM) channels, the all-optical switching site comprising:

   an optical add/drop multiplexer having add paths for adding channels to any of the at least one output optical fiber links, and drop channels for extracting channel signals from any of the at least one input optical fiber links;

   an adaptive dispersion compensation module (ADCM) in each drop path adapted to compensate for intra-channel wavelength dispersion in a received dropped channel signal; and

   an optical transmitter for each add path.

2. An all-optical switching site as claimed in claim 1 wherein the optical transmitter for each add path comprises a tunable optical laser.

3. An all-optical switching site as claimed in claim 1 wherein the ADCM comprises:

   a dispersion compensation element (DCE) adapted to apply dispersion compensation to the channel signal; and

   an adaptive controller (AC) adapted to control the dispersion compensation applied by the DCE.

4. An all-optical switching site as claimed in claim 3 wherein the AC is adapted to receive control feedback from a downstream signal analyzer, and to use the feedback to adjust the dispersion compensation applied to the dropped channel signal, in order to minimize the intra-channel dispersion of the dropped channel signal.

5. An all-optical switching site as claimed in claim 4 wherein the control feedback is generated at one of:

a signal analyzer that receives a portion of the channel signal via a drop path signal tap; and

a receiver adapted to convert the channel signal to a digital electrical signal.

6. An all-optical switching site as claimed in claim 5 wherein the control feedback comprises a parameter related to dispersion.

7. An all-optical switching site as claimed in claim 6 wherein the parameter comprises at least one of: a signal-to-noise ratio; a signal dispersion measure; at least one feature of an eye-closure diagram; a spectral content analysis of the signal; and a bit error rate associated with data encoded by the signal.

8. An all-optical switching site as claimed in claim 5 wherein, at the time of provisioning a channel to be dropped to a drop path, the adaptive controller computes a coarse-grain signal dispersion adjustment

setting based on an estimate of the channel signal's intra-channel dispersion.

9. An all-optical switching site as claimed in claim 8 wherein the estimated dispersion is calculated using at least one of: a distance that the optical signal has traveled through the network; the type of optical fiber links over which the signal was conveyed; the channel's center wavelength; and, the amount of dispersion compensation applied to the channel a last time the channel was dropped.

10. An all-optical switching site as claimed in claim 1 wherein the all-optical switching site comprises a receive path for each of the at least one input optical fiber links, each receive path comprising:

an optical pre-amplifier;

a bulk dispersion slope compensation module (DSCM) adapted to correct for intra-channel dispersion incurred in all of the channels during transmission through the input optical fiber link;

an optical power amplifier; and

a de-multiplexer for de-multiplexing the plurality of channels.

11. An all-optical switching site as claimed in claim 10 wherein the optical add/drop multiplexer further comprises an all-optical switch adapted to selectively switch each de-multiplexed channel and

each added channel to one of a drop path, and an output channel path.

12. An all-optical switching site as claimed in claim 11 wherein each output channel is conveyed over a respective output channel path prior to multiplexing, and each output channel further comprises a variable optical attenuator (VOA) adapted to adjust the signal intensity of the channels, to permit the all-optical switching site to dynamically control inter-channel intensity balance for channels output on a common output optical fiber link.

13. An all-optical switching site as claimed in claim 12 further comprising a VOA controller for controlling the VOAs of each output channel path that is multiplexed onto a given output optical fiber link, wherein the VOA controller is further adapted to:

receive inter-channel intensity balance information from a downstream optical signal analyzer;

calculate changes to the amount of attenuation to be applied to respective channel signals to control inter-channel intensity balance; and

control the attenuation of respective channel signals accordingly.

14. An all-optical switching site as claimed in claim 13 wherein:

the all-optical add/drop multiplexer comprises a plurality of optical switches;

at least some of the add/drop paths of each of the optical switches are transfer add-drop paths;

each transfer add-drop path is connected to another all-optical add/drop multiplexer; and

the transfer add-drop paths are adapted to switch channels from the all-optical add/drop multiplexer to the another all-optical add/drop multiplexer.

15. An all-optical switching site as claimed in claim 11 wherein the optical add/drop multiplexer comprises a single optical switch with a plurality of input optical fiber links and a plurality of output optical fiber links, wherein the optical switch is further adapted to switch de-multiplexed channels of any of the plurality of input optical fiber links to respective output channels of any of the output optical fiber links.

16. An all-optical switching site as claimed in claim 13 wherein the optical switch is a fully redundant optical cross-connect with duplication of every channel signal conveyed through the optical switch, and the all-optical switching site further comprises an additional amplifier to compensate for signal intensity lost by splitting and recombining the channel signal.

17. An all-optical switching site as claimed in claim 13 wherein the all-optical switch de-multiplexes and switches only a sub-set of the channels carried on the all-optical switch's input optical fiber link,

and the remainder of the channels bypass the all-optical add/drop multiplexer.

18. A method of compensating for net dispersion of a signal transmitted over a variable number of optical fiber links in a wave division multiplexed/ dense wave division multiplexed optical network, comprising steps of:

receiving the signal on a channel;

analyzing a quality of the received signal;

sending a measure of the quality to an adaptive controller (AC) of a dispersion compensation element (DCE);

computing a dispersion compensation adjustment at the AC using the measure of quality; and

controlling the DCE to apply the dispersion compensation adjustment to the signal in order to reduce intra-channel dispersion of the signal.

19. A method as claimed in claim 18 wherein the step of receiving the signal comprises using a receiver to perform steps of:

converting the signal from an optical signal to an analog electrical signal; and

computing an eye-closure diagram using properties of the analog electrical signal.

20. A method as claimed in claim 19 wherein the step of analyzing comprises a step of determining a quality of the signal using properties of the eye-closure diagram.

21. A method as claimed in claim 18 wherein the step of receiving comprises steps of receiving a portion of the signal sent to the DCE at a signal analyzer.

22. A method as claimed in claim 21 wherein the step of analyzing comprises a step of analyzing the optical signal at the signal analyzer, in order to measure signal quality.

23. A method as claimed in claim 21 wherein the step of receiving further comprises steps of:

converting the optical signal into an analog electrical signal; and

computing an eye-closure diagram using properties of the analog electrical signal.

24. A method as claimed in claim 23 wherein the step of analyzing comprises a step of determining a quality of the signal using at least one property of the eye-closure diagram.